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FROM THE

UNITED STATES GOVERNMENT

THROUGH

Engineer dept.





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60TH CONGRESS }
2d Session }

HOUSE OF REPRESENTATIVES

{ DOCUMENT
No. 1481

FINAL REPORT OF SURVEY OF CUMBERLAND RIVER, TENNESSEE AND KENTUCKY

LETTER FROM THE ACTING SECRETARY OF
WAR TRANSMITTING, WITH A LETTER FROM
THE CHIEF OF ENGINEERS, FINAL REPORT OF
SURVEY OF CUMBERLAND RIVER, TENNESSEE
AND KENTUCKY, BELOW NASHVILLE

FEBRUARY 24, 1909.—Referred to the Committee on Rivers and Harbors
and ordered to be printed, with illustrations

WASHINGTON
GOVERNMENT PRINTING OFFICE
1909

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From the
U. S. Government.

CUMBERLAND RIVER, TENNESSEE AND KENTUCKY.

LETTER

FROM

THE ACTING SECRETARY OF WAR,

TRANSMITTING,

WITH A LETTER FROM THE CHIEF OF ENGINEERS, FINAL REPORT OF SURVEY OF CUMBERLAND RIVER, TENNESSEE AND KENTUCKY, BELOW NASHVILLE.

FEBRUARY 24, 1909.—Referred to the Committee on Rivers and Harbors and ordered to be printed, with illustrations.

WAR DEPARTMENT,
Washington, February 24, 1909.

SIR: I have the honor to transmit herewith a letter from the Chief of Engineers, U. S. Army, of this date, together with copy of a final report from Maj. William W. Harts, Corps of Engineers, dated January 18, 1909, on a survey of Cumberland River, Tennessee and Kentucky, below Nashville, made by him in compliance with the provisions of the river and harbor act of March 2, 1907.

Very respectfully,

ROBERT SHAW OLIVER,
Acting Secretary of War.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 24, 1909.

SIR: Referring to letter from this office, dated March 10, 1908, and in further compliance with the law, I now have the honor to submit herewith for transmission to Congress a final report dated January 18, 1909, by Maj. Wm. W. Harts, Corps of Engineers, on survey authorized by item in section 1 of the river and harbor act approved March 2, 1907, as follows:

Improving Cumberland River, Tennessee and Kentucky, below Nashville: The Secretary of War may cause a survey to be made with a view to the improvement by locks and dams of that portion of the river heretofore surveyed in which no locks and dams have been constructed.

In the section of the Cumberland River below Nashville, Tenn., one lock and dam (A) has already been constructed, and in the report transmitted with office letter of March 10, 1908, and published in House Document No. 758, Sixtieth Congress, first session, sites were indicated and estimates submitted for the next two locks and dams (B and C) in the series beginning at Nashville and extending downstream.

As a result of his further investigation the local officer now proposes the construction of three more locks and dams (D, E, and F) to complete the system, or six in all, together with the necessary dredging between the lowest lock and the mouth of the river to afford a channel 150 feet wide and 6 feet deep at low water. The cost of these three locks and dams, and the dredging proposed, is estimated at \$1,905,688.80, which, together with the estimates heretofore submitted for Locks and Dams B (\$562,926) and C (\$696,267.60), makes a total of \$3,164,882.40 for the work remaining to be done to complete the project for 6-foot navigation on the river below Nashville.

I concur in the opinion of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors that Cumberland River below Nashville is worthy of improvement in the manner proposed.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

FINAL REPORT OF SURVEY OF CUMBERLAND RIVER BELOW NASHVILLE, WITH A VIEW TO IMPROVEMENT BY LOCKS AND DAMS OF THAT PORTION HERETOFORE SURVEYED IN WHICH NO LOCKS AND DAMS HAVE BEEN CONSTRUCTED.

ENGINEER OFFICE, UNITED STATES ARMY,
Nashville, Tenn., January 18, 1909.

SIR: In further compliance with the clause of the act of Congress approved March 2, 1907, providing for the survey of the Cumberland River, Tennessee and Kentucky, below Nashville, I have the honor to submit final report on this survey, supplementing my first report of February 19, 1908, published in House Document No. 758, Sixtieth Congress, first session.

The survey directed by the above-mentioned act of Congress was commenced in August, 1907, and completed in December, 1908. During the working season of 1907, acceptable sites for Locks B and C were selected, as indicated in my report of February 19, 1908, to which attention is invited. The survey was interrupted by high water in December, 1907, and was not resumed until June, 1908, as the stage of water would not permit active operations at an earlier date.

Considerable difficulty was found in selecting sites where foundations were suitable and where other conditions would at the same time be favorable for navigation. A number of tentative sites were examined and rejected, but suitable locations were finally determined upon for Locks D, E, and F. Lock D has been located near Dover, Tenn., where rock was found at an average depth of 6 feet under the lock and of about 30 feet under the abutment, three other sites having been developed before the final selection was made. The greatest difficulty was experienced at Lock E, the site for which was ultimately decided upon after examining and rejecting eight locations.

Although rock was found at reasonable depths for the location of the locks at the sites chosen for both D and E, the depth to rock on the abutment side in each case is so great as to make it more desirable to construct the abutment of concrete supported on piles, rather than attempt to carry the foundations to rock. Likewise, a crib dam with concrete top will be more economical at each of these sites than the type of concrete dam contemplated at other localities. These modifications are adopted for this report, and are included in the estimates.

The rock surface under water and under the banks was developed in all cases by means of probings with a steel rod, the character of the rock being later examined by sinking holes with a core drill to a depth of at least 5 feet in the solid ledge. The locations of borings and probings are shown on the maps of the sites submitted herewith. In all borings at accepted sites, solid rock of sufficient thickness for satisfactory foundations was encountered.

The total cost of the survey work was \$18,927.83, distributed as follows:

Lock site B, examination, maps, etc.....	\$968. 76
Lock site C, location and development.....	2, 075. 64
Lock site D, location and development.....	6, 831. 70
Lock site E, location and development.....	2, 316. 32
Lock site F, location and development.....	2, 077. 20
Survey below Lock site F.....	2, 662. 19
Duplicate levels, Clarksville, Tenn., to Smithland, Ky.....	1, 996. 02

18, 927. 83

All the locks are designed with a lift of about 12 feet, although slight variations were rendered necessary by the local conditions, Lock F having a proposed lift of 13.1 feet, Lock E 10 feet, and Lock D 11 feet. The elevation of pool "D" is 329.1, of pool "E" 318.1, and of pool "F" 308.1 (all above Gulf datum at Mobile).

In the following table are shown the results of discharge observations taken by the survey party:

Cumberland River below Nashville.

Locality.	Elevation of gauge zero. ^a	Gauge reading.	Calculated discharge.	Date of observation.
	<i>Feet.</i>	<i>Feet.</i>	<i>Cu. ft. per sec.</i>	<i>1908.</i>
Lock site D.....	313.6	0.0	1, 185	Oct. 12
Do.....	313.6	0.0	1, 312	Oct. 13
Do.....	313.6	12.0	21, 421	May 25
Do.....	313.6	15.4	27, 566	Apr. 23
Do.....	313.6	15.5	27, 724	May 23
Do.....	313.6	18.3	29, 156	May 16
Do.....	313.6	19.0	29, 447	May 15
Do.....	313.6	19.0	35, 510	May 20
Do.....	313.6	19.8	42, 834	Apr. 29
Do.....	313.6	21.1	39, 959	May 6
Do.....	313.6	25.2	56, 441	May 1
Do.....	313.6	28.1	59, 726	Feb. 13
Do.....	313.6	37.1	84, 909	Feb. 17
Lock site E.....	306.4	0.0	1, 928	Oct. 10
Lock site F.....	295.0	0.0	1, 403	Oct. 16
			1, 434	
Big Horse Ford.....	291.5	0.0	1, 275	Nov. 3
Mouth of river.....	289.0	1.8	5, 553	Dec. 3

^a Assumed low water.

Dam:

Earth excavation, 2,825 cubic yards, at \$1.....	\$2, 825. 00	
Rock excavation, 1,000 cubic yards, at \$2.....	2, 000. 00	
Concrete, 6,300 cubic yards, at \$10.....	63, 000. 00	
		\$67, 825. 00

Abutment:

Excavation, 17,300 cubic yards, at \$0.50.....	8, 650. 00	
Embankment, 9,800 cubic yards, at \$0.50.....	4, 900. 00	
Concrete, 2,550 cubic yards, at \$8.50.....	21, 675. 00	
		35, 225. 00

Upper guard wall:

Excavation, 1,700 cubic yards, at \$1.....	1, 700. 00	
Concrete, 1,280 cubic yards, at \$9.....	11, 520. 00	
		13, 220. 00

Bank protection:

Paving, 2,530 square yards, at \$3.50.....	8, 855. 00	
Hand-placed riprap, 5,950 square yards, at \$2.50.....	14, 875. 00	
Heavy stone (derrick), 970 cubic yards, at \$2.50.....	2, 425. 00	
Piles (24 feet long), 500 at \$10 each.....	5, 000. 00	
		31, 155. 00

Temporary buildings.....

5, 000. 00

Lockmen's houses.....

15, 000. 00

Grading and fencing.....

3, 000. 00

554, 850. 00

Office expenses, 5 per cent.....

27, 742. 50

Engineering, contingencies, and inspection, 15 per cent.....

83, 227. 50

Total..... 665, 820. 00

The survey of the river between the mouth and the lowest lock shows that dredging will be necessary at a number of places to afford a channel 150 feet wide and 6 feet deep at low water. The most important of these localities, with the estimated quantities of dredging necessary, are as follows:

Big Horse Ford.....	cubic yards..	71, 500
Little Horse Ford.....	do....	35, 000
Springs Landing.....	do....	6, 800
Below Cumberland River bridge.....	do....	37, 800
Camp Rowdy.....	do....	80, 600
Iuka.....	do....	11, 000
Pinckneyville.....	do....	19, 000
Mouth of river.....	do....	67, 500

Total..... do.... 329, 200

The other localities are of minor importance, and the work necessary for their improvement is included in the estimates given above. The cost of this excavation, taken at 25 cents per yard, amounts to \$82,300. To this should be added 5 per cent for office expenses and 15 per cent for contingencies and inspection, making a total of \$98,760.

The following is a summary of the estimated cost of the entire work proposed

Lock and Dam "B" near Hollingsworths Landing, or Hurricane Creek, Tenn.....	\$562, 926. 00
Lock and Dam "C" near Reynolds Landing, or Yellow Creek, Tenn ..	696, 267. 60
Lock and Dam "D" just below Dover, Tenn ..	577, 300. 80
Lock and Dam "E" just above Canton, Ky ..	563, 808. 00
Lock and Dam "F" just above Eddyville, Ky ..	665, 820. 00
Dredging below Lock F.....	98, 760. 00

Total..... 3, 164, 882. 40

With this report are submitted the following maps pertaining to the survey:^a

- | | |
|--|---|
| (1) Sections of dams. | (12) Map of Cumberland River, Dover to mouth. |
| (2) Sections of dams. | (13) Location of Lock D. |
| (3) Sections of lock walls. | (14) Location of Lock E. |
| (4) Hydrograph: Lock I. | (15) Location of Lock F. |
| (5) Design of Lock B. | (16, 17, 18, 19) Map of Cumberland River from lock site F to mouth. |
| (6) General plan, Lock B. | (20) Shoals requiring dredging below Lock F. |
| (7) Guard wall, abutment, and dam, Lock B. | (21) Shoals at mouth of Cumberland River. |
| (8) Detail of upper end of Lock B. | |
| (9) Detail of lower end, Lock B. | |
| (10) Upper gate, Lock B. | |
| (11) Lower gate, Lock B. | |

Very respectfully,

WM. W. HARTS,
Major, Corps of Engineers.

The CHIEF OF ENGINEERS, U. S. Army.
(Through the Division Engineer.)

[First indorsement.]

ENGINEER OFFICE, U. S. ARMY, CENTRAL DIVISION,
Cincinnati, Ohio, January 23, 1909.

Respectfully forwarded to the Chief of Engineers, U. S. Army.

This report, with the preliminary report submitted by the district office February 19, 1908, completes the report called for in section 1 of the river and harbor act approved March 2, 1907.

The whole project comprises six locks and dams canalizing the Cumberland River, Tennessee and Kentucky, below Nashville, for a distance of 147 miles; the rest of the river to the mouth to be dredged to a depth of 6 feet at low water for a width of 150 feet, a distance of about 50 miles.

One of the six locks has been built and the district officer estimates that to complete the project will cost \$3,164,882.40.

The estimates have been well worked out and I concur with his views.

WM. T. ROSSELL,
*Colonel, Corps of Engineers,
Division Engineer, Central Division.*

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 1, 1909.

Respectfully returned to the Chief of Engineers, U. S. Army.

The within report is supplemental to one submitted by the district officer under date of February 19, 1908, made in compliance with the river and harbor act of March 2, 1907, which, with the report of this Board, is published as House Document No. 758, Sixtieth Congress,

^a Of the maps accompanying this report only (4), (12), (16), (17), (18), (19), (20), and (21) are printed. In addition to these the map and profile of Cumberland River from Nashville to Dover, Tenn., showing the proposed locations and proposed water surfaces for Locks and Dams B and C, and the hydrograph showing stages of the upper and lower pools at Lock A and diagram showing the rainfall at Burnside, Ky., for the years 1905, 1906, and 1907, submitted with the preliminary report of February 19, 1908, are also printed.

first session. The object of the investigation as stated in the act is "with a view to the improvement by locks and dams of that portion of the river heretofore surveyed in which no locks and dams have been constructed."

The preliminary report just referred to contained estimates for two locks and dams, B and C, and the statement that three or four more, depending upon the lift adopted, would be required to complete the system below Nashville. The survey reported on within developed the fact that three additional locks and dams would be required, which the district officer estimates will cost: D, \$577,300.80; E, \$563,808; F, \$665,820; total, \$1,806,928.80. Adding to this amount the estimated cost of Locks B and C, already submitted in the preliminary report, viz, \$562,926 and \$696,267.60, respectively, makes the total cost of the locks and dams required for the completion of the system below Nashville, \$3,066,122.40. Lock A has already been completed.

The district officer states that in addition to the construction of the locks and dams, certain dredging, estimated to cost \$98,760, will be required between the mouth of the river and the lower lock in order to secure a depth of 6 feet and afford facilities equal to those proposed in the river above. The amount necessary therefore for the complete improvement contemplated is \$3,164,882.40. The annual cost of operation and maintenance is estimated by the Board at \$40,000.

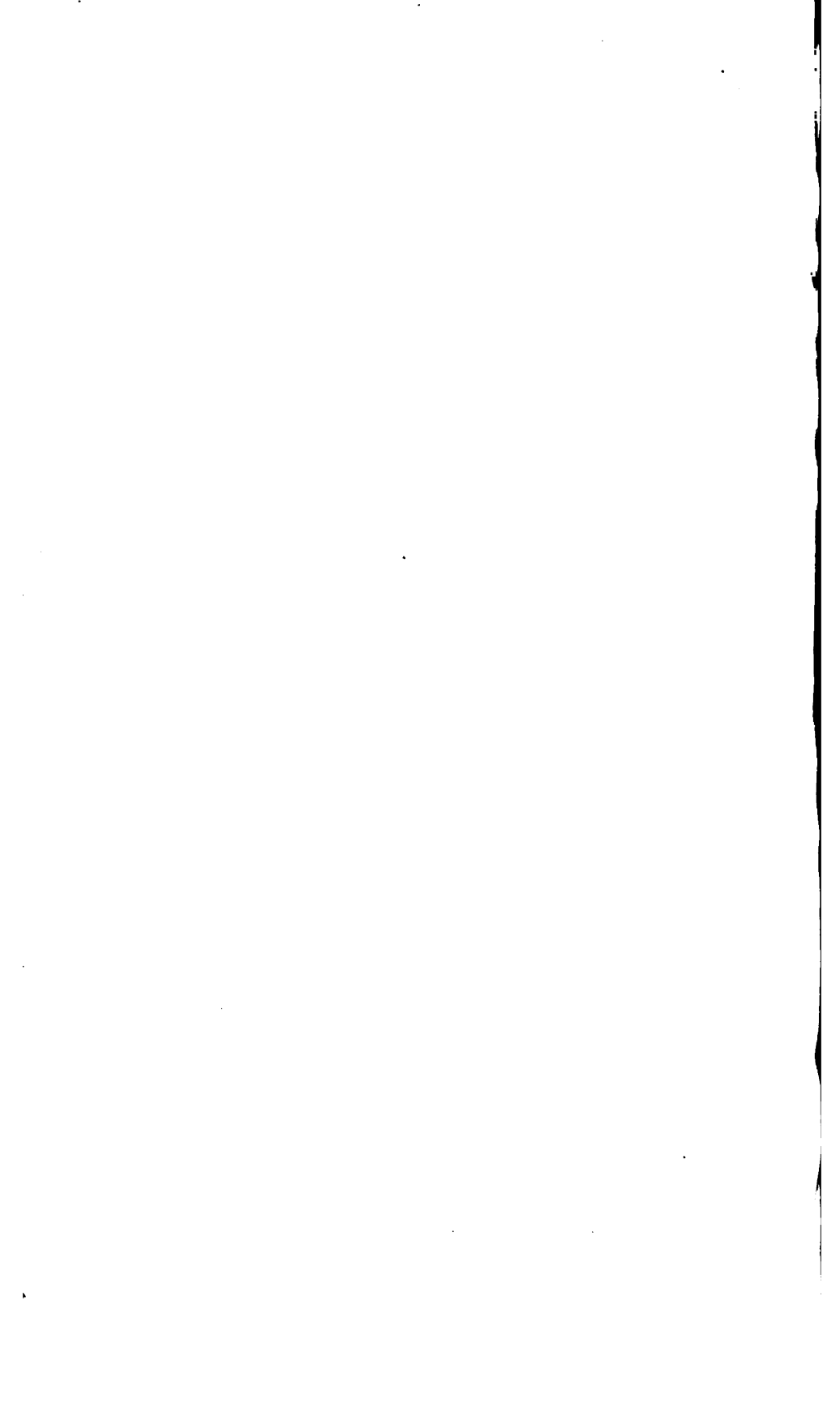
In a report dated February 26, 1906, published as House Document No. 699, Fifty-ninth Congress, first session, reviewing the project for the improvement of the Cumberland River, in which the subject was carefully considered, the Board expressed the opinion that the regulation of the river and the construction of the remaining locks and dams of the system below Nashville were worthy of being continued by the General Government. The Board adheres to the views then expressed.

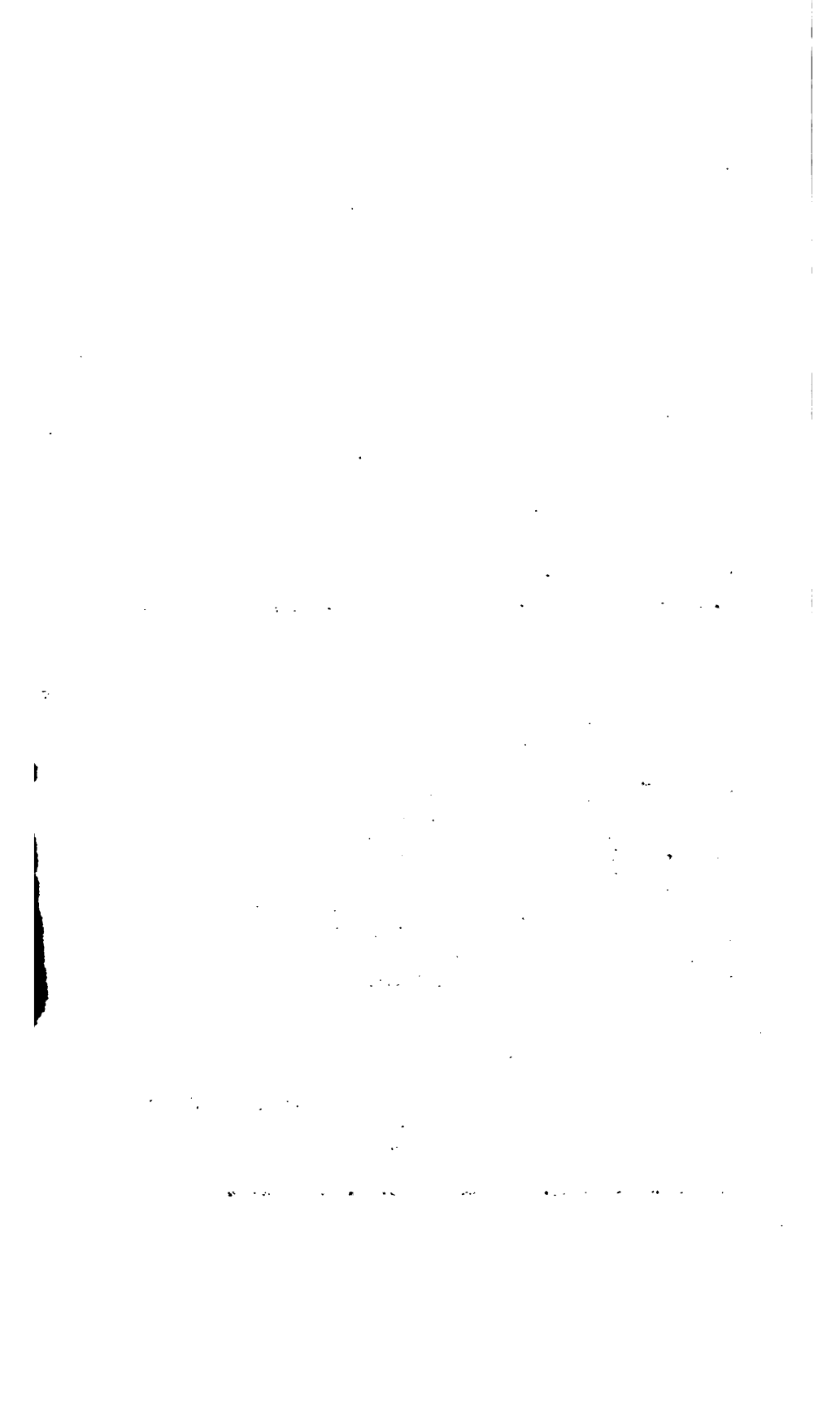
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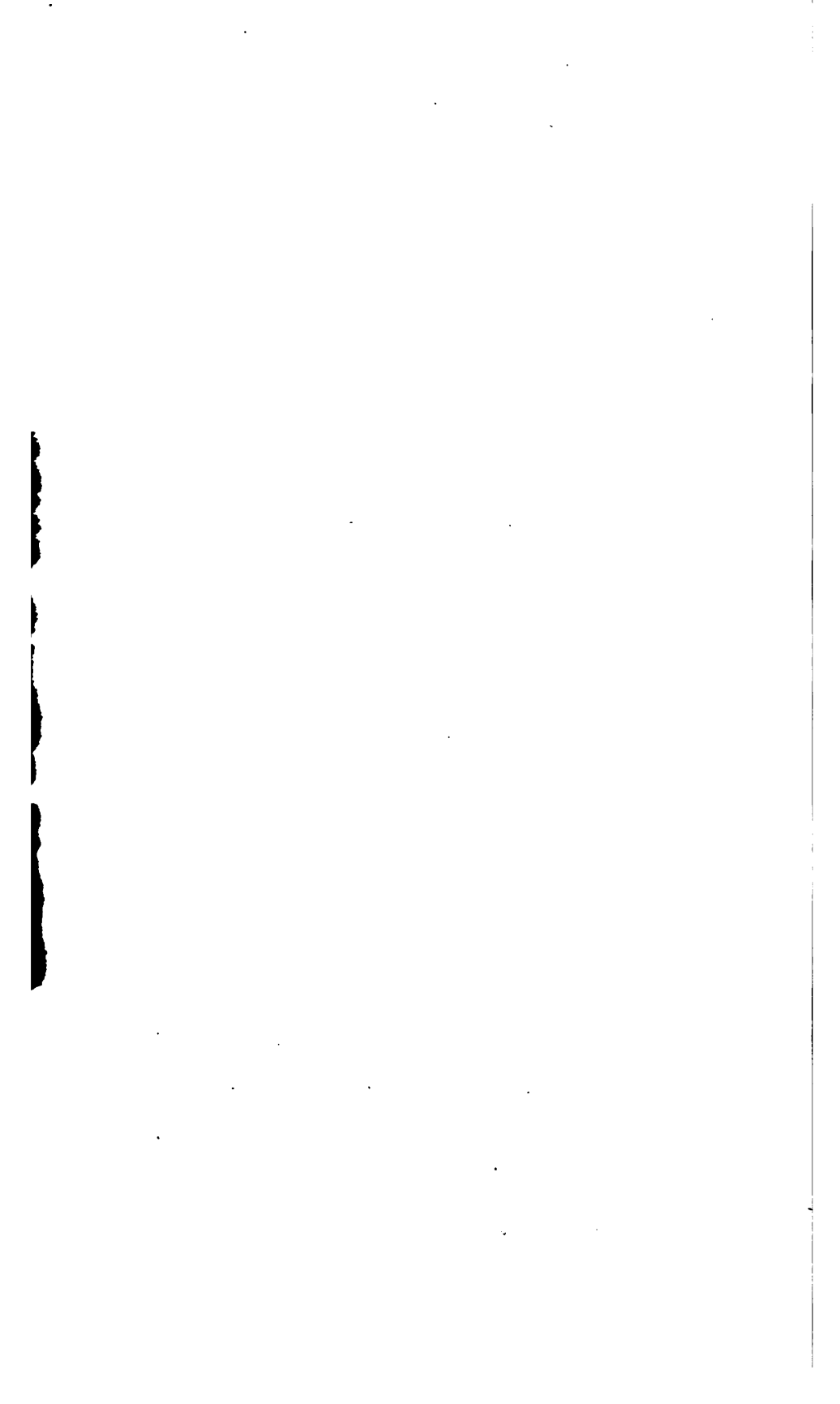
D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

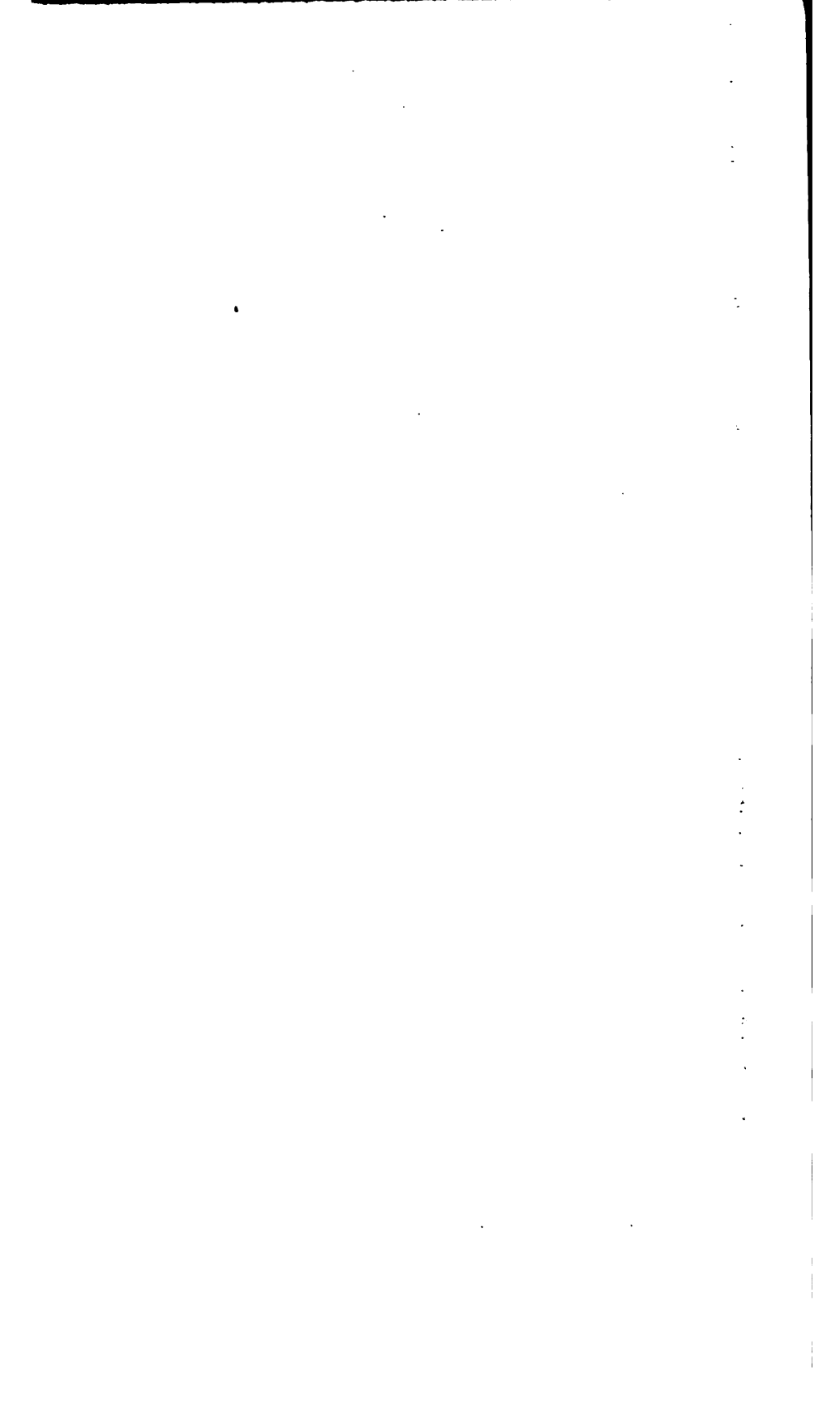
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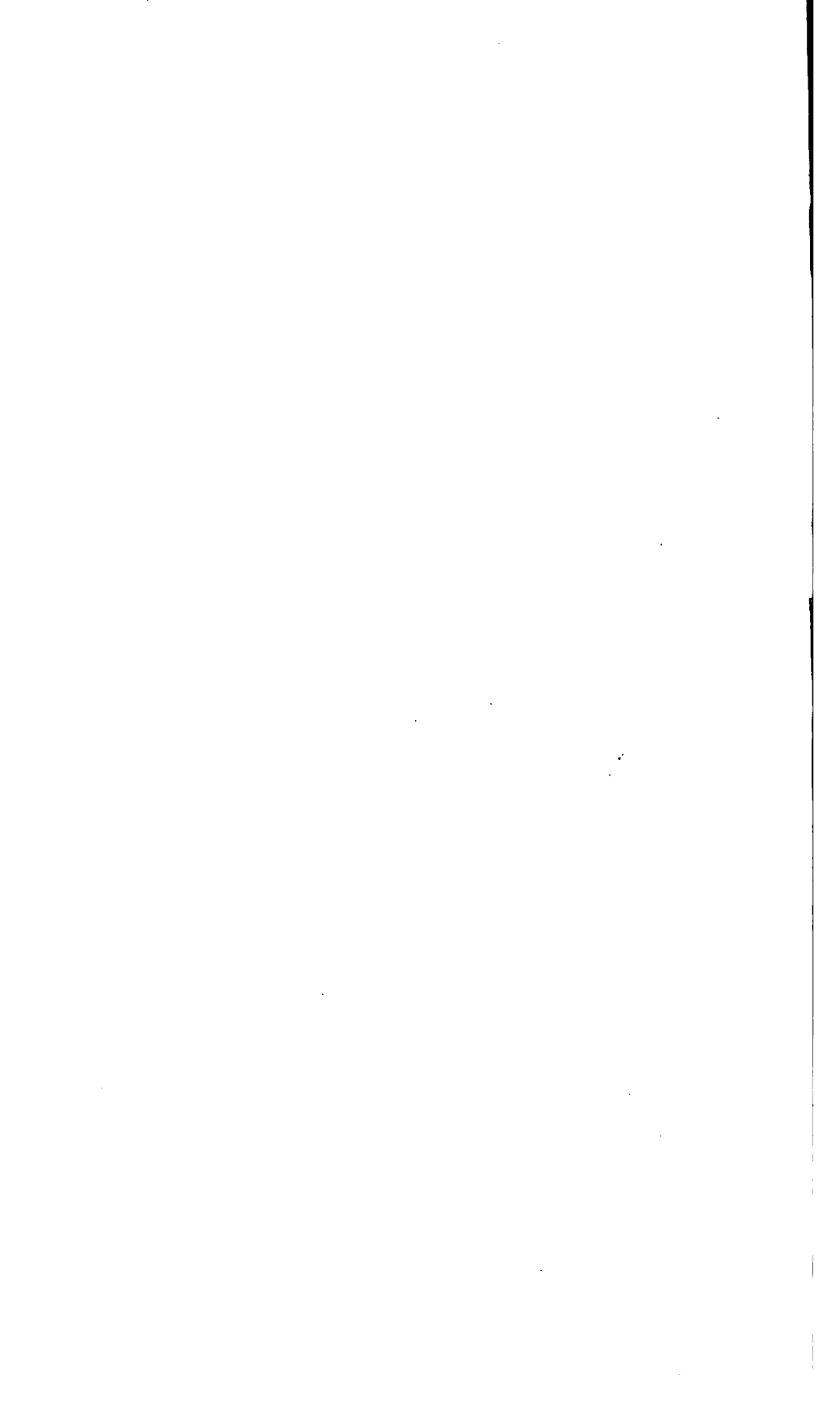
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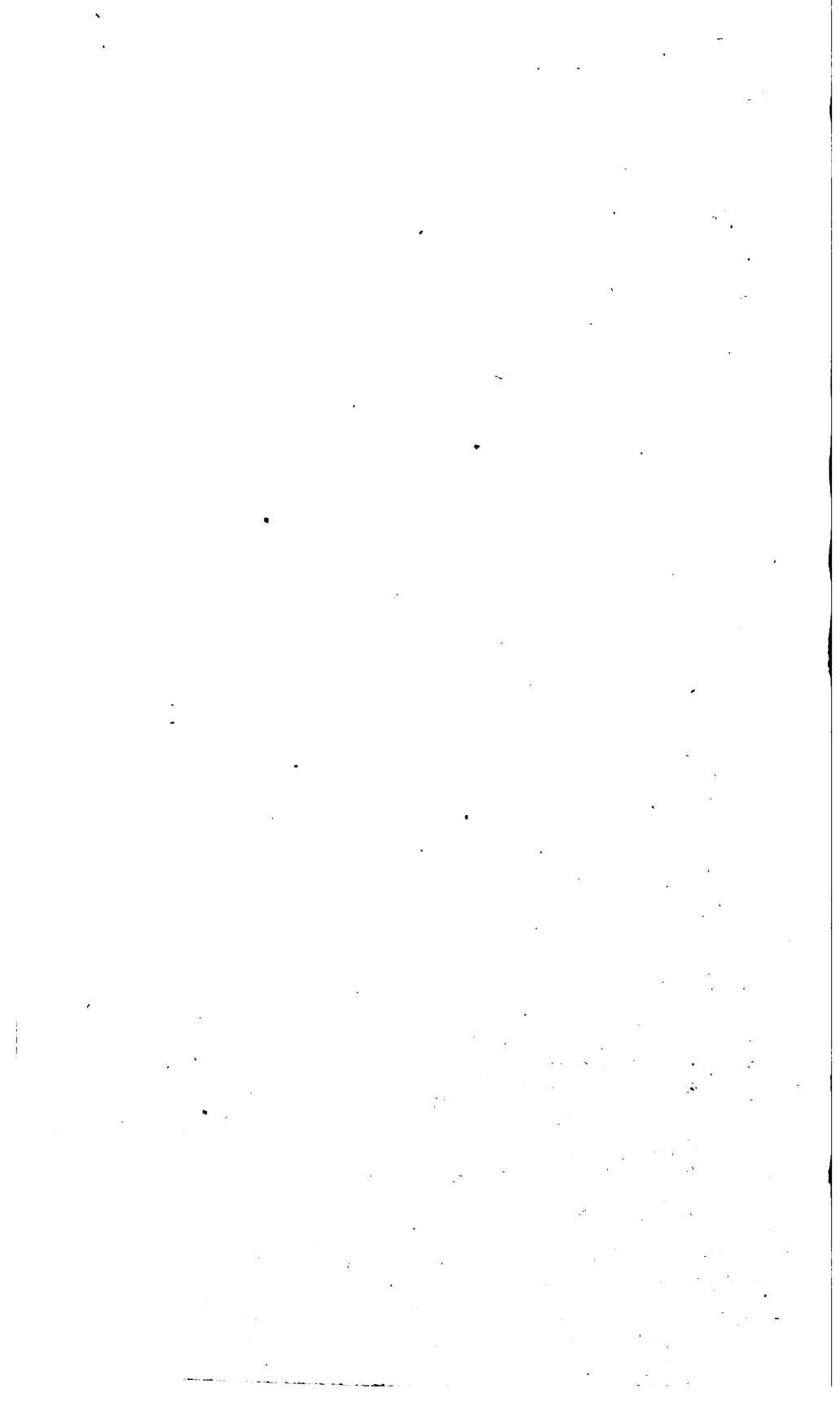














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